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Specification as originally filed, with Application for Patent Serial No: **2,331,558**, on January 18, 2001, by **FRANK E. BUNN, DAVID HUGHES and STEVEN KATZ** for "System and Method for Multiplexing Wireless Device".

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SYSTEM AND METHOD FOR MULTIPLEXING WIRELESS DEVICES

Wireless communications is a global and rapidly expanding technology. It is just this expansion which is using up the precious resources of radio frequency bandwidth and phone number assignment. The advent of wireless cellular telephony for digital information applications such as pagers, e-mail and internet, point of sale terminals, and the like, to say nothing of the wireless telephone voice systems applications is compounding this resource depletion problem. Several alternative systems and networks are common, including analogue and digital voice systems, data only systems, cellemerty, short data burst packetization, microburst technologies and the like. All are depleting these resources.

Well known in the technology is the use of identifier codes for each wireless device in the form of an Electronic Serial Number (ESN) and a Mobile Identification Number (MIN). It has been the practice in the industry to assign one and only one wireless network system calling number, such as a cellular phone number, to one and only one mobile device having a unique ESN/MIN combination of identification codes. The subject of several patents, such as US 5,765,107, US 5,905,949 and US 6,097,939, has been to develop systems to detect the use of more than one mobile device using the same ESN/MIN in the case where fraudulent use can be traced.

It is standard practice in the industry, that every time a wireless network communications device is powered, meaning the transceiver is powered on, the device transmits its unique code, such as the ESN/MIN pair, to the wireless network communications system with which the device is designed to function. As long as the device is powered it is common practice that such devices also send the code at fixed or random, but repeated, intervals to the wireless system with which it is designed to function. Additionally, it is common practice that, every time the device attempts to send a message or communication to the network system, the device also transmits its unique ESN and/or MIN codes to that system during the initialization of that communication. The system checks the codes to verify that the device is allowed to use the system, and, if verified, allows the device to conduct the communications utilizing the system.

Here we disclose a method and apparatus for multiplexing the use of a given pair of identifying codes in order to conserve these wireless communications resources. The method is to duplicate the identification codes, such as the unique ESN/MIN, in multiple similar devices and to schedule a cycling sequence for the use of each of these devices such that the transceiver of only one is powered on at any given time. This time could be time of day but could also include day of week, month, year, etc. With careful scheduling, the one ESN/MIN could utilize the wireless network at an efficiency of 100% of the time, 365 days per year!

Say, for example, 10 cellular telephones were established with the same ESN/MIN, and each was provided with the apparatus and programs that permitted it to be powered for a specific amount of time, say 6 minutes, then turn off for a specific amount of time, say 54 minutes. Then, it could be arranged and scheduled such that out of every hour each device could operate from any location for six minutes and no two device transceivers would be powered at the same time, but the power to the device itself to maintain the device and its scheduling would remain operational. This way ten users could operate on the wireless communications system every hour without requiring ten phone numbers, and as they would never be operating at the same time, would only require the bandwidth needed for one device.

To function with most of the existing wireless network communications systems, each of the ten devices in the above example would need to be individually registered with the system under one user identification for billing purposes. The practice in the industry is that one unique set of identification codes, such as ESN/MIN pair, is assigned to only one device and one customer for both billing and network access purposes. This is not a requirement of the apparatus and method being disclosed here, but it is the way in which most existing systems currently operate.

The practice of assigning one phone number to each new device identification codes (ESN/MIN) accessing the network, imposes significant costs onto the communications network provider. These costs include, but are not limited to: establishing new phone numbers, expanding the network data base system for each new number, expanding the telephony switching systems to handle the new numbers, expanding the automated billing systems to handle the new numbers, maintaining ever larger network systems to support more numbers. These costs to the network

providers could be slashed by orders of magnitude through the application of the methods and apparatus revealed. For example, assigning one phone number to, say, 10 devices each with identical identification codes approved for accessing the network, could reduce these costs by a factor of 10 to 1!

This example could mean that if one user would typically access the network for an average of say 6 minutes use per hour, then in the ten-device example, the network could be utilized for a full 60 minutes per hour. The end result could be that the users of the network gain a 10 to 1 saving in system access fees and the network system providers could gain a 10 to 1 increased income from more use of the network. All this improvement in efficient use of the network at reduced cost and increased income is in addition to the gains from conserving the frequency bandwidth and device's calling phone number resources noted earlier.

Even more significant gains could come from opening up new markets for the network providers implementing these methods and apparatus. There are numerous low volume data reporting applications such as remote metering devices, for example, which need to report small quantities of data on a regular, but infrequent basis. Wireless data transmission would be an ideal solution but the fixed costs to network providers, and indirectly to end users, of maintaining a unique ESN/MIN pair for each device make use of existing wireless networks too expensive to be commercially viable. Multiplexing of wireless devices using the method described herein, could reduce costs substantially with the result that such applications using "Limited Time" access to the network could bring new revenue streams to the network providers without using up precious phone number and bandwidth resources. Additionally, gains could be realized as the methods and apparatus have application across multiple platforms, including but not limited to, analogue and digital cellular phones, one-way pagers and two-way pagers. Markets not even thought of now can be opened up for the network providers.

A significant saving for users of the methods and apparatus of this disclosure method is the cost saving in fees to access the system. The way most existing network systems operate is to charge an access fee, often fixed monthly, annually, or such like, for each device, with its unique identification codes such as ESN/MIN, approved to access the network. The method here

allows as many devices that have been established with the same codes to access the network for the one fee. Additionally, where network providers offer blocks of network access time packaged into the fixed fee-period, applications which require small amounts of access time per month are wasting paid for access. The method and apparatus disclosed can multiplex these applications so that the packaged access time could be utilized fully in each fee-period making 100% efficient use of the service paid for by the user and provided by the network.

The number of devices that could be multiplexed is nearly limitless, and only depends upon the length of power-on-time and scheduling of that on-time. As another example, if 1,440 devices were to be utilized, and all given the same length of power on times of say one minute, then in one day (1440 minutes) they all could access, or be accessed by, the network system. An application example of this use could be the automatic reporting of electricity meter readings, where metering facilities at the electricity user's location could be appropriately equipped and programmed to call in to a billing office once per month to report the current electricity usage from the metering facility.

The only restriction is that no two wireless devices be powered on at the same time. This limit is a result of the fact that wireless communications network providers route messages to a specific identification set of codes such as ESN/MIN combination and would be unable to route messages appropriately if two or more devices with the same ESN/MIN combination were to access the network simultaneously. This restriction is not a limitation of the method and apparatus being disclosed. The length of time any one device is powered on need not be a function of any other device's on time. The scheduling must be coordinated for all devices having the same codes, and this facility would need to be built into the devices themselves. This scheduling could be set or reset remotely via the communications network or a central calling facility sending the scheduling to the device configured to receive and store the schedule. The scheduling also could be loaded and stored into the device by physically connecting it to a scheduling system or the device could have the scheduling stored permanently in the device. In the event of a power failure to the device, when power is restored the device must be configured so that the transmitter component remains off until the device checks the scheduling or power on cycling

sequence stored in the device's non-volatile memory to determine when that device is scheduled to apply power to its transceiver.

Whether the wireless device initiates the call to the communications network or a host central system calls the device, the function and the scheduling requirement are the same. In the case where the wireless device is placing a call to the communications network, the device must have the facility to maintain accurate time and have calling scheduling stored within the device. In the case where the centralized facility calls the device, the scheduling could be maintained in the central facility and the wireless device need only store the time of day and duration of power-on time. In both cases, the device is envisioned to facilitate wireless updating of the time of day, the power-on duration and time of power-on.

In the case where the device automatically calls to a centralized facility to automatically report, the device must be configured to have stored in its memory the scheduling of what information is to be reported, as well as the cycling sequence of current time of day, power on duration, and the time of power on for the device's transceiver. In the case where a person is using the device to initiate a voice or data call, the device still must retain the cycling sequence of current time of day, power on duration, and the time of power on for the device's transceiver. The device can be configured to display to the user, current time and /or time remaining until the next transceiver power-on cycle and duration sequence for that device.

The applications for this multiplexing of devices is very broad and not limited to the geographic location of the device, nor the wireless communications system receiving facility, location nor the wireless communications system itself. The applications include, but are not limited to, regular voice communications and data communications, and are not limited to the type of networks or the protocols on which they operate, including such as analogue AMPS, or digital CDMA, GSM, TDMA, CDPD, nor limited by the devices themselves, including such as cellular phones, pagers, personal assistants, or their operating systems.

In the 10 device example, this could be ten cellular telephones used by ten people of a group, and each phone could be programmed to access the network only at preset times. The phone could

be programmed such that it will alert the user when that phone's network system access time is active. In this example, each of the users in the group could make a voice call limited in time to once per hour and limited in duration to 6 minutes.

In the 1440 device example, this could be 1440 electric meters which simply initiate the call, rapidly report data to a central facility, and terminate the call within one minute, and all 1440 within one day. If meter readings are only needed once per month, and if the calls are each of one minute duration or less, then for a 30 day month 31,320 devices could report meter readings.

In an application where the device is located in a mobile unit, say a vehicle, and if the location of the vehicle is important, the device could contain the apparatus and facility to access the global positioning system of satellites (GPS). In this case, the accurate updating of time and date as well as position could be acquired from the GPS communications. The device could then also report the GPS information as well as the information for which the device was designed and implemented. Another example where the device could automatically update its stored time of day is where the device is configured in such a way that it could connect with a source of time calibrations such as the standard broadcast time signals from W W V, in the USA, or C H U, in Canada and the like.

In any of these applications, the limited duration of a call by any one device, and hence the limit of information communicated during a call, could be augmented by the device having the facility to segment the information to be transmitted. The device could begin transmitting information and as the transmission progressed, the device could recognize that the call termination time limit was near, and so could close off the current information transmission and terminate the call within the time limit, such that the device could continue the transmission in the next allowed transmitter power-on cycle, picking up from the point at which it left off in the previous call. This way there would be no limit on the amount of information transmitted from any given device. The facility being called would need to have the appropriate facility to receive segmented information and be able to reassemble these segments for a complete message. Error correction methods familiar to the technology could be incorporated in both the devices and the

central facility to assure any messages or segments received or interrupted could be retransmitted so that messages could be successfully assembled.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method and system for the Time Division Phone Number, TDPN, comprising a multiplicity of telephony devices, each having identifying unique code numbers such as ESN and MIN numbers associated with cellular wireless devices, and each having a local controller capable of receiving from a central controller, storing and implementing the fuzzy logic operational instructions needed to assign to each device a unique operational time and operational duration such that no two devices are active at the same time on the same telephony network but each having the same Phone Number, PN.
2. A method and apparatus according to claim 1, located at the central controller sufficient to create and transmit by land line or wireless telephony methods, the fuzzy logic necessary to operate within each local controller in the receiving telephony device in order to control the active operation of that local telephony device regarding the time the device is actively turned-ON, the duration of that ON-time and the turn-OFF time.
3. A method and apparatus according to claim 1, located at the local controller sufficient to store assigned unique code numbers such as ESN and MIN of cellular telephones and a phone number all of which can be recognized by a telephony network.
4. A method and apparatus according to claim 1, located at the local controller sufficient to receive and store the assigned unique code numbers such as ESN and MIN of cellular telephones and a phone number and the fuzzy logic operational instructions needed to activate the local telephony device as to the device's actively turned ON time, the duration of that ON-time and the turn-OFF time
5. A method and apparatus according to claim 1, located at the central controller sufficient to store and operate on the fuzzy logic operational instructions needed to assign, keep track of, communicate and exchange information with a multiplicity of local telephony devices having unique identification codes and TDPN's such that no two telephony devices would be communicating with the network at the same time.
6. A method and apparatus according to claim 1, located at the local controller sufficient to turn on the local telephony device at the ON-time prescribed in the fuzzy logic received and stored from

the central controller and leave the device ON for the prescribed duration and then turn the device OFF at the prescribed OFF-time.

7. A method and apparatus according to claim 1, located at the local controller sufficient, in the case of a wireless cellular telephone device, that the local controller would power on the device such that its transceiver would communicate with the prescribed telephony network permitting that the device to send and receive calls on that network for the prescribed duration period being such that the local controller would then turn off the power to the device such as to terminate the communication of the device to the network.